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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/757,586	01/15/2004	Robert D. Edwards	EI-2-04-001	4656

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EXAMINER

VAN, LUAN V

ART UNIT	PAPER NUMBER
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1753

DATE MAILED: 07/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/757,586

Applicant(s)

EDWARDS, ROBERT D.

Examiner

Luan V. Van

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 June 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 19-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 13, 2006 has been entered.

Response to Amendment

Applicant's amendment of June 13, 2006 does not render the application allowable.

Status of Objections and Rejections

All rejections from the previous office action are withdrawn in view of Applicant's amendment.

New rejections under 35 U.S.C. 103(a) are necessitated by the amendments.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 19-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al. '727 in view of Taylor et al. '833 and Tsuchida et al.

Regarding claim 19 and 29, Taylor et al. '727 teach a method of electrolytically plating a layer of metal on the internal surface of an opening within a printed circuit board, said method comprising: substantially immersing a substrate having an opening therein within an electroplating bath containing ions of a metal to be deposited onto the internal surface of said opening (Example) and further containing brighteners and levelers (column 14 line 24 -- column 15 line 16); and passing an electric current through said bath (Example) wherein said current includes modulated forward and reverse pulses having a duration of from about 0.83 μ s to about 200 ms (column 9 lines 17-22), selected ones of said forward and/or reverse pulses followed by a pause (off-period, column 6 lines 36-40) in said electric current, so as to deposit a substantially uniform layer of said metal on said internal surface of said opening without filling said opening with said metal (figure 3C). Taylor et al. '727 specifically teach "An off-period or

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relaxation period may follow either or both of the cathodic and anodic pulses" (column 6 lines 36-40).

Taylor et al. '727 differ from the instant claims in that the reference does not explicitly disclose the specific off - period time duration; the specific ratio of the current densities; or the aspect ratio of the instant claims, although Taylor et al. '727 teach "the practitioner will adapt the pulse width, duty cycle, and frequency to a particular application, based on the principles and teachings of the process of the invention" (column 8 lines 17-21), and through holes typically have diameters greater than about 250 μm (column 8 lines 46-54).

Taylor et al. '833 teach a pulse reversing current electroplating process in which an experiment was performed with another board using waveform comprising a cathodic pulse of 28 amperes per square foot current density for 13.7 milliseconds, followed by a period of no current for 0.3 milliseconds, and then an anodic pulse of 28 amperes per square foot for 2 milliseconds (Example). The circuit board was provided with through holes having aspect ratios of about 3:1 to 20:1 (Example).

Tsuchida et al. teach "The ratio of current density during the electrolysis is normally 1 to 10, and preferably 225 reverse electrolysis to 1 forward electrolysis. A ratio of current density during electrolysis lower than 1 reverse electrolysis to 1 forward electrolysis makes it difficult to make the plating speed of copper deposition near the sealed end face of blind via-holes slower than the plating speed near the opening because adsorbed sulfated compound near the opening of blind via-holes cannot be adequately desorbed, and a ratio of current density during electrolysis greater than 10

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reverse electrolysis to 1 forward electrolysis tends to increase the time required to fill blind via-holes by causing the copper film already deposited to dissolve." (Paragraph 68).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor et al. '727 by using the off - period time of Taylor et al. '833, because such off - period time would provide a uniform electroplated metal in the interior surfaces of through-holes, cavities and the like having high aspect ratios (column 3 lines 62-65). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have further modified the method of Taylor et al. '727 by using the circuit board having the aspect ratios of Taylor et al. '833, because such circuit board would be desirable for forming a double-sided and multilayer printed wiring boards. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have further modified the method of Taylor et al. '727 by using the ratio of current density of Tsuchida et al., because it would electroplate via-holes uniformly and without voids (paragraph 68 of Tsuchida et al.)

Regarding claims 20 and 30, Taylor et al. '833 teach the ratio of times of the forward pulse to the reverse pulse to the pause is about 46:7:1, as calculated from the parameters in the Example provided above. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor et al. '727 by using the the ratio of times of Taylor et al. '833, because it would

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provide a uniform electroplated metal in the interior surfaces of through-holes, cavities and the like having high aspect ratios (column 3 lines 62-65).

Regarding claims 21, 22, 24-25, 31, 32 and 34-35, Taylor et al. '727 differs from the instant claims in that the reference does not explicitly disclose the specific current density of the instant claims (claims 21-22 and 31-32); the copper concentration of the instant claims (claims 24 and 34); or the sulfuric acid concentration of the instant claims (claims 25 and 35).

Tsuchida et al. teach the forward current density is 0.1-20 A/dm², or about 1-20 Amperes per square foot, and the reverse current density is from about 0.1-200 A/dm², or about 1-200 Amperes per square foot, (paragraph 68), which is within the ranges of the instant claim; Tsuchida et al. teach a copper sulfate concentration of 20-250 g/L, or about 8-100 g/L of copper, (paragraph 71); and Tsuchida et al. teach a sulfuric acid concentration of 30-400 g/L (paragraph 71).

Addressing claims 21, 22, 31 and 32, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor et al. '727 by using the current densities of Tsuchida et al., because would electroplate via-holes uniformly and without voids (paragraph 68 of Tsuchida et al.)

Addressing claims 24 and 34, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor et al. '727 by using the copper concentration of Tsuchida et al., because it would form a fine and bright electrodeposited film (paragraph 55-56 of Tsuchida et al.)

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Addressing claims 25 and 35, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor et al. '727 by using the sulfuric acid concentration of Tsuchida et al., because such acid concentration range provides sufficient conductivity to the plating bath without hindering the copper sulfate from dissolving or precipitating the copper sulfate (paragraph 71 of Tsuchida et al.)

Regarding claim 23 and 33, Taylor et al. '727 teach an electroplating method wherein the electroplating bath further includes organic brighteners and carriers (column 14 line 58 -- column 15 line 30).

Regarding claims 26 and 36, Taylor et al. '727 teach using sulfuric acid (Example).

Regarding claims 27 and 37, Taylor et al. '727 teach an electroplating method wherein the substrate is a fiberglass-reinforced epoxy resin (column 16 lines 10-12).

Regarding claims 28 and 38, Taylor et al. '727 teach electroplating copper (Example).

Response to Arguments

Applicant's arguments filed June 13, 2006 have been fully considered but they are not persuasive.

In the arguments presented on page 7 of the amendment, the applicant argues that Taylor et al. '727 teach away from using brighteners and levelers. The examiner respectfully disagrees. Taylor et al. '727 specifically teach "The use of conventional

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plating bath additives is not excluded in the process of the invention, but it is preferred to minimize their use to avoid the problems indicated above." (Column 14 lines 44-47). Disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. *In re Susi*, 440 F.2d 442, 169 USPQ 423 (CCPA 1971).

The applicant further argues that Taylor et al. '727 do not teach the ratio of current density of amended claims 19 and 29. The examiner acknowledges that Taylor et al. '727 does not explicitly teach this specific ratio. However, Taylor et al. '727 specifically teach "The pulse width, duty cycle, and applied voltage of the cathodic and anodic pulses must be adjusted, within the parameters defined for the first pulse train of the process, to provide that the overall process is cathodic, i.e., there is a net deposition of metal on the substrate workpiece. The practitioner will adapt the pulse width, duty cycle, and frequency to a particular application, based on the principles and teachings of the process of the invention." (Column 8 lines 14-21). This teaching suggests that one having ordinary skill can modify the applied voltage, i.e. current density, to suit the particular application, such as electroplating a uniformed metal deposit on circuit boards.

Applicants' arguments with respect to the Martin et al. reference have been considered but are moot in view of the withdrawal of the rejection using Martin et al.

Conclusion

The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.


Hubel teaches plating using a reverse current density much greater than the forward current density (Fig. 1d).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LVV
July 17, 2006


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